

Structural Evaluation Report

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October 3, 2007

Mr. Wendall Kalsow
McGinley Kalsow & Associates LLP
324 Broadway, PO Box 45248
Somerville, MA 02145

Re: Needham Town Hall Study
Preliminary Structural Condition Assessment

Dear Wendall:

At your request I, surveyed the condition of the Needham Town Hall. The object of the survey was to examine the exterior masonry at east and west end walls to assess previously identified problems—bulges and deteriorated masonry joints—and generally look for structural deficiencies throughout the building.

BACKGROUND

Purpose

This assessment is part of a study to review Town Hall office space needs. The program calls for reusing the existing building and reviewing options to renovate the building. A previous investigator (Gale Associates, Inc.) had identified bulges and deteriorated masonry joints. As bulges in brick masonry indicate movement which can precede a partial collapse of wall sections, their assessment is understood as a high priority. An earlier investigator (Kaestle Boos Associates, Inc.) had assessed the building as a structurally robust building leading this team to not expect to find significant structural deficiencies. This study relies primarily on a visual survey to validate earlier opinions.

Description

Town Hall is a bearing wall frame where the north, south, and two corridor walls support wood floor joists. The exterior walls are solid unreinforced brick construction. The exterior north and south walls support timber roof trusses. Pilasters reinforce these walls at truss locations. The building appears uninsulated in general. Some insulation may be realized in the basement where the walls are faced with Tectum panels. No insulation is present in the attics.

SURVEY

On September 26, 2007, this writer met with Town personnel to survey the Town Hall structure. Attached at the end of this report are annotated digital photographs documenting conditions and drawings illustrating conditions of interest. This survey started by viewing the west and then the east elevations on a bucket crane from the Town's Park and Recreation Department. Afterward, the custodian escorted the writer through the building starting in the attic, down through the balcony, second floor, first floor and finishing in the basement. Reading through the photos and sketches at this point will help to understand what follows.

EVALUATION

Within the building, much of the structure is concealed behind plaster walls and ceilings and flooring preventing direct measurement of structural framing or inspection. In general, the floors and walls appear adequately supported which indirectly indicate the structure is adequate. Observations of identified problems and questionable construction are as follows:

1. West and east end walls.
 - a. Along the roof line, exterior mortar joints are breaking down. The fractured mortar is a result of moisture drawn into the walls and freezing. As the water turns to ice, it expands and fractures mortar. Masonry at the roof line undergoes a greater range of temperature changes where little heat reaches the masonry in freezing weather. The effects of the environment are compounded by the use of common brick as backup for face brick and the use of mortar mixes not formulated for extreme conditions. The problem is more extensive on the east wall.
 - b. Coping units do not appear to have flashing between the units and the brick. The coping stones are now sealed with elastomeric type caulking and tied together with face mounted cramps. Some sketches of what appears original construction indicate the vertical steps in the parapet now faced with vertical coping once held larger stones. This may have been the case also at the kneelers which traditionally held large stones to lock the sloped coping in place. These are now brick covered by metal.
 - c. Mortar in belt course head joints is falling out.
2. East end wall.
 - a. A horizontal bulge lies between the south wall and the large window at the level of the ceiling. This bulge is a result of water trapped in the backup portions of the wall freezing and turning to ice. This process fractures the softer backup brick and pushes the face brick outward.
 - b. A vertical bulge lies over the top of the large window. It developed for the same reasons as the one in item 2.a.
 - c. Freeze action is eroding the interior face of the wall within the attic.

3. North and south side walls. Anchors for balcony railings are breaking apart brick units in which they are embedded. This is typically a process where rusting iron/steel expand and pry apart brick units.
4. Cupola. From the exterior, the cupola appears stable and in its original position. From the inside, the discoloration of the deck underside is suspect for mold or fungi deterioration. The hazardous environment prevented a closer inspection.
5. Roof trusses. The roof trusses appear reasonably proportioned. From experience, this writer does not find roofs that are overdesigned. Most are designed for a snow load and no more. The addition of steel gusset plates should raise the question, why were they added? They do not appear designed by an engineer familiar with timber truss design. The bolts are too few and too small to adequately transfer forces for trusses of this size. These gussets conceal the original joinery preventing a visual inspection of the joints.
6. Service ramp. The retaining wall at the service ramp areaway is leaning inward. It appears undersized at resisting lateral earth pressures.

RECOMMENDATIONS

Until a program is developed that addresses the level of desired restoration, reuse, and additional construction, only repair type work can be identified. These are as follows:

1. Urgent masonry repairs. Stabilize the bulges in the east wall by either rebuilding facing and broken backup brick at the bulges or by adding temporary interior and exterior bracing to constrain the bulges.
2. Long term masonry repairs.
 - a. Rebuild masonry in the end walls susceptible to freezing. Use brick throughout the thickness of the wall that is rated for severe weather. Rebuild with mortar that is freeze resistant.
 - b. The gray overlay mortar poses a problem of deciding to live with it or restore the joints to their original buff color and texture. The latter option requires cutting and repointing all the joints. The side walls do not need much repointing. The end walls need repointing where rebuilding is carried out. To get consistency in color, the choice is complete repointing with the original buff color or less repointing with the subsequent gray.
 - c. Reset all the coping stones with flashing in the bed joints. Restore missing coping stones.
 - d. Repoint and add lead T-caps to belt head joints.
 - e. Replace balcony railing anchors with stainless steel and rebuild brick around their supports.

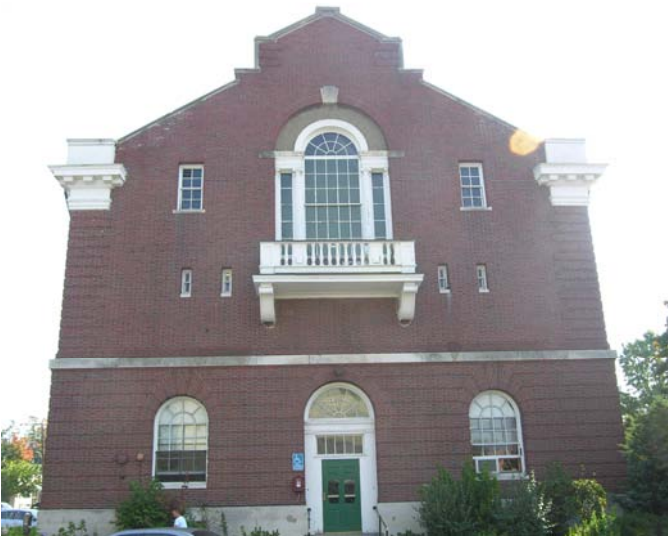
3. Cupola assessment.
 - a. Employ a hazardous waste removal contractor to clean the cupola.
 - b. Apply a bird and insect screen to the cupola.
 - c. Carry out a structural survey in the cupola.
4. Roof truss assessment.
 - a. Find records to explain why gussets were added to the trusses.
 - b. Or, measure the trusses, carry out a stress analysis, and carry out an inspection of the joints by selectively removing several plates at disparate joints. One of the joints should be at the truss heel. This will require trade assistance to provide access, temporary shores, and plate removal and reinstallation.

Sincerely,



Arthur H. MacLeod, P.E., Principal
MacLeod Consulting, Inc.

Attachments: 33 Captioned Photographs, Three Existing Condition Drawings



1. West elevation Town Hall.
Photographs two through twelve
are taken from this wall.



2. Metal kneeler cover by roof
eave above cornice. Near top,
brick is set back about four
inches behind metal cover. In
traditional masonry, this kneeler
would have been a stone unit.



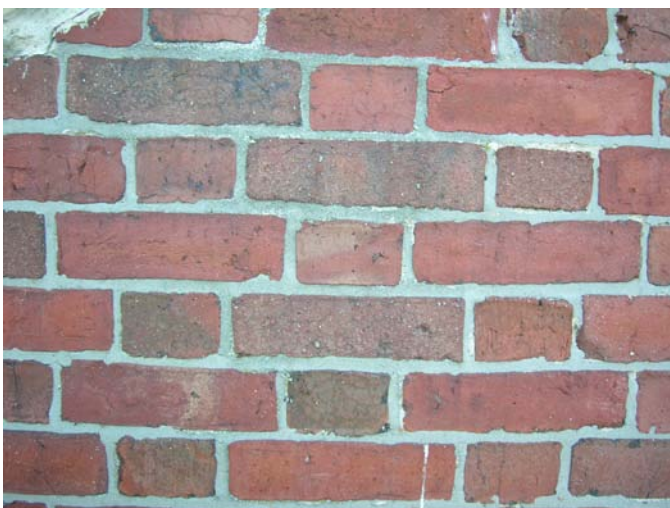
3. Step in coping at near top of
wall. Brick facing joints are
cracking on edge of wall.
Vertical coping is not a standard
use in traditional masonry.



4. Coping head joints tied together with metal cramps covered with asphalt shingles.



5. Cracked mortar joints in brick edge of wall. Stone coping bed joints covered with elastic sealants.



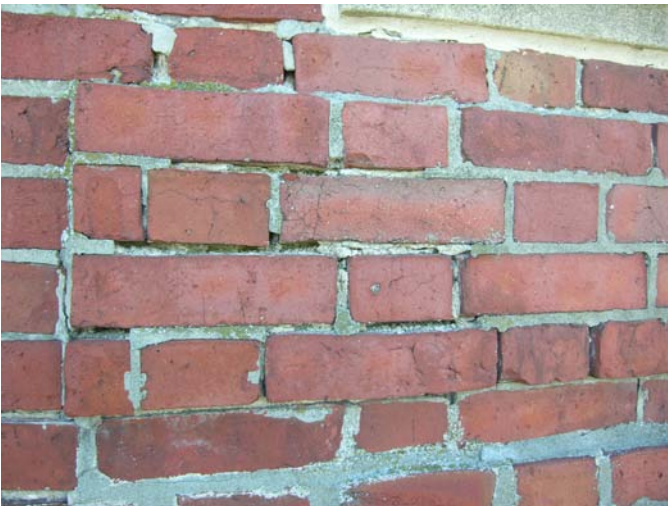
6. Masonry joints covered with thin veneer of gray mortar.



7. Close up view of thin overlay of mortar in joints. This gray mortar conceals a buff colored mortar.



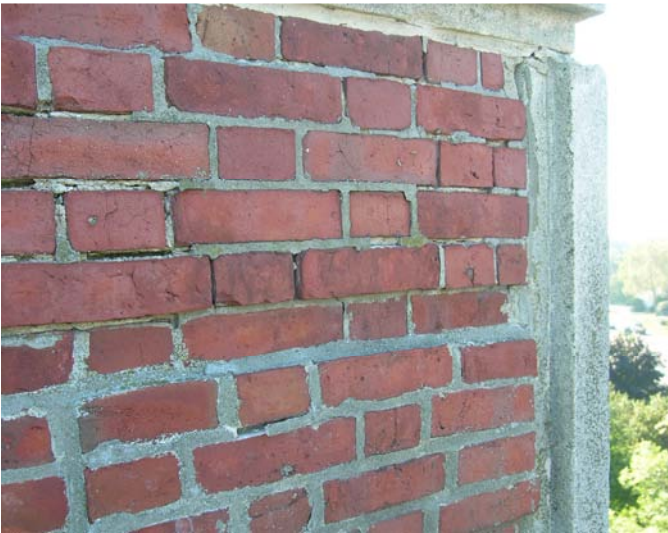
8. Some joints are missing mortar one brick deep.



9. Common condition of mortar joints in wall at roof line



10. Closer view of broken mortar joints. Note mortar within joints is broken in layers. This is commonly seen in brick walls that are subjected to freezing.



11. Broken joints near large step in coping.



12. View of wall over top of large window. A radial band of stucco conceals the ceiling line.



13. East elevation Town Hall. Photographs fourteen through eighteen and twenty-one are taken from this wall.



14. Wall over window appears repaired at a time different than when wall was repointed with an overlay of mortar. Two white patches are from an investigation several years ago. Mortar is missing above brick arch on south half of window.



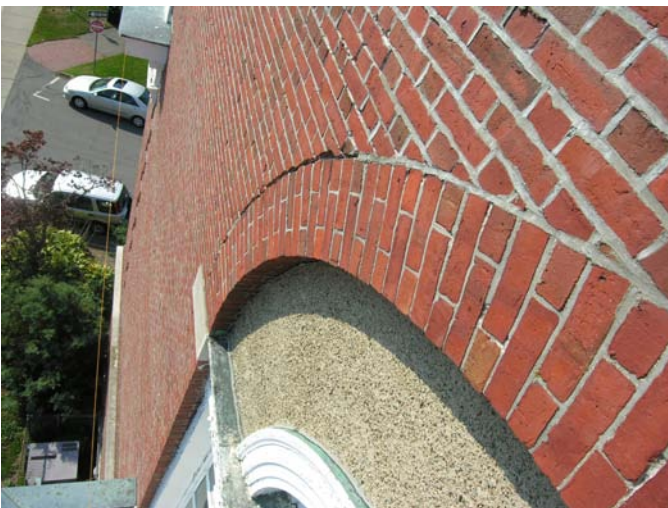
15. Close up view of wall over window showing broken mortar joints.



16. Vertical bulge in wall over window.



17. Horizontal bulge in wall south of window. One can scale the extent of the curvature knowing the level is two and one half inches wide and scaling the distance between the edge of the level and its shadow.



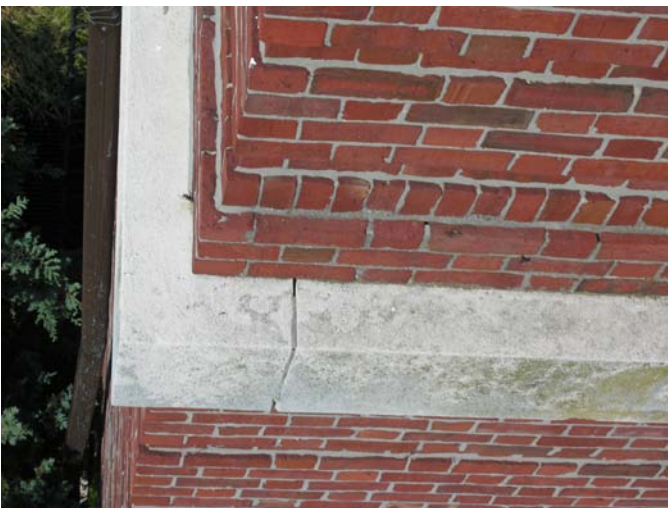
18. Mortar missing from window arch. Several points on this wall were measured for plumb by holding a plumb bob to the orange mason line shown in the background.



19. The cupola as seen from the east end of the building.



20. Roof as seen from the west end of the building. Balustrades have added bracing to supplement tie rods. Brick on the concealed side of the parapets have the same detailing as that on the exposed side.



21. Mortar missing from head joints in stone belt.



22. Close up view of mortar overlaid on original buff colored mortar.



23. Mortar missing from head joints in stone facing at base of building.



24. Cracked unit and missing mortar from stone at base of building.



25. Cupola viewed from attic. This writer did not enter this area as cupola is actively occupied by pigeons, which are well known to soil their roost with guano and fungi hazardous to humans. The whitish stains on the underside of the cupola deck may indicate deterioration in that wood.



26. East wall gable viewed from within the attic.



27. Close view of east wall in attic. Mortar is eroding from frost action. Faces of brick are scaling off bodies of units.



28. Left over slate shingles add unnecessary weight to ceiling joists.



29. Suspended ceiling over second floor added in the mid 1900's. The center is supported on corridor walls. The areas supported by hangers are not work platforms. Planks in these areas indicate trade mechanics have used this ceiling as a work platform.



30. Light fixtures are supported on steel gusset plates. This suggests the lights illuminated the former hall after the gussets were installed. Such gussets were not used during the period of original construction.



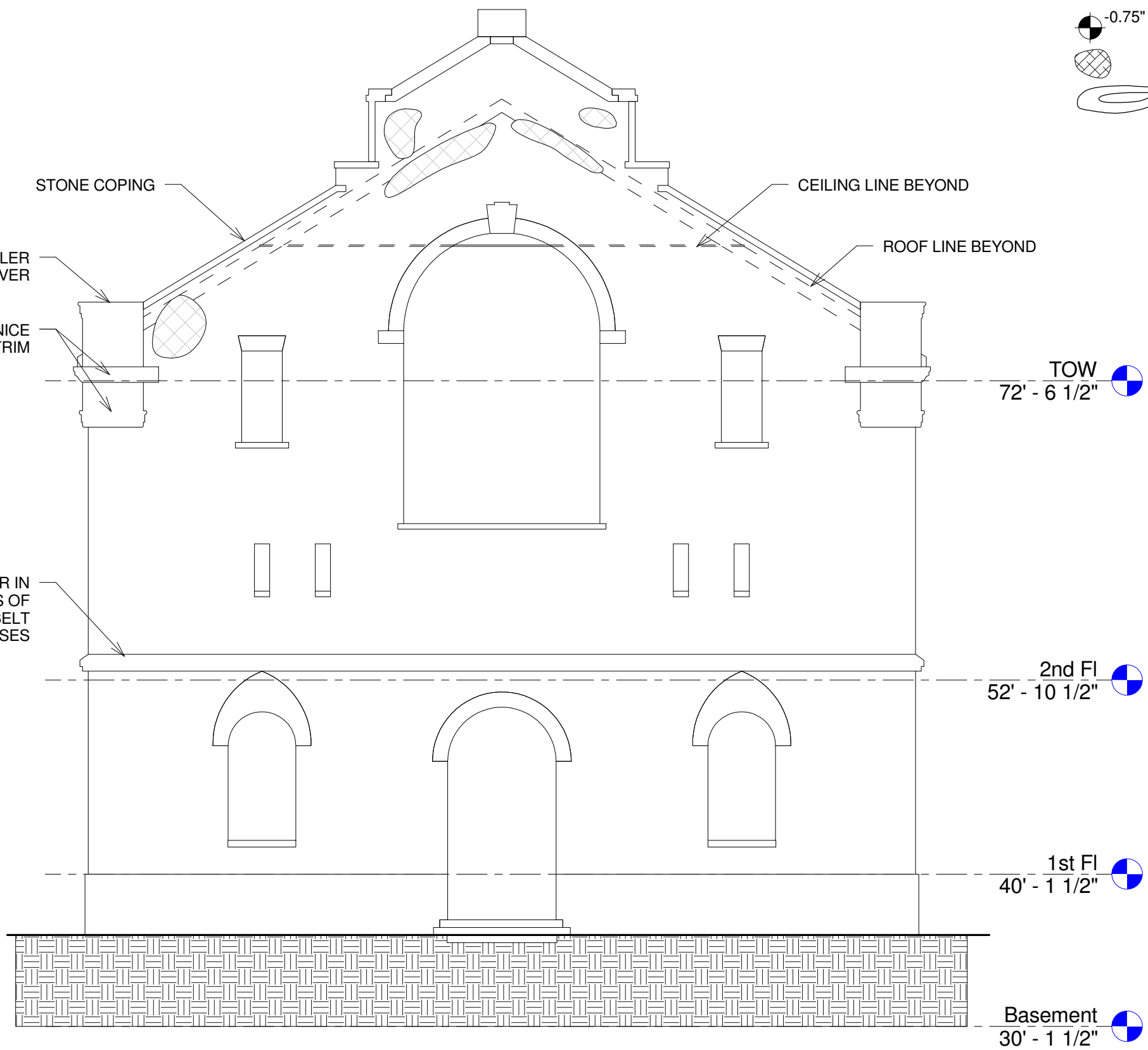
31. Closer view of a gusset. The wood dentil molding was cut away to make space for the gussets. The bolts are too few and too small to adequately carry forces for timbers of this size. These were added after original construction but the reason why is not apparent.



32. Steel channels were added to the top chords of the two trusses under the cupola. The cupola posts can be seen penetrating through the ceiling.



33. The retaining wall along the service ramp is dislocated.



DEFECT LEGEND

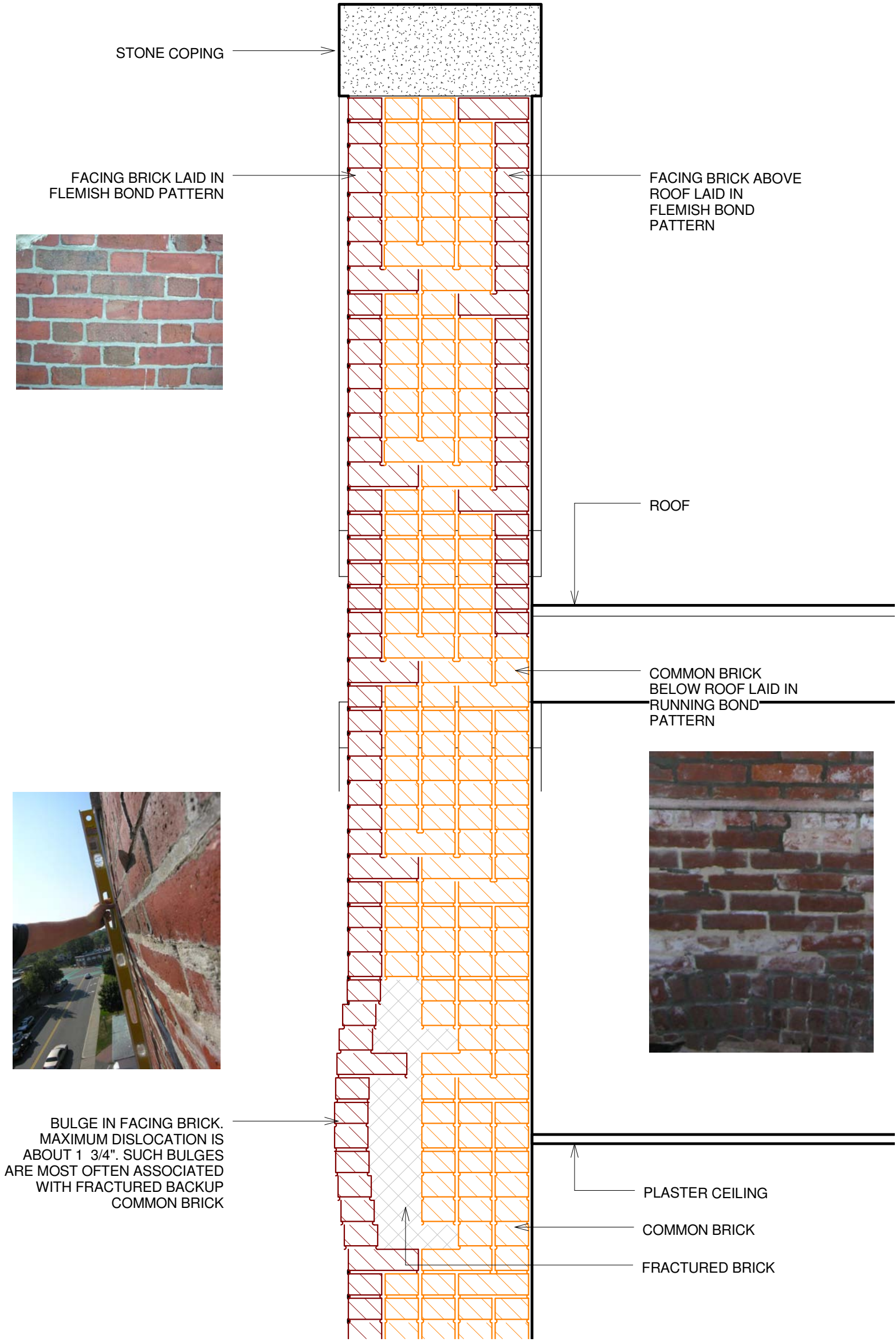
- 0.75" DEVIATION FROM VERTICAL PLANE
- CRACKED MASONRY, BROKEN MORTAR
- BULGE CONTOUR

MOST DETERIORATION SEEN IN THESE END WALLS IS NEAR THE ROOF LINE WHERE BRICK CYCLES THROUGH GREATER FREQUENCIES AND RANGES OF TEMPERATURE CHANGES LEADING TO TRAPPED MOISTURE FREEZING WITHIN WALLS DURING WINTERS.

1 West Elevation
1/8" = 1'-0"

Study

SHEET TITLE	West Elevation Masonry Condition		
	PROJECT		
CLIENT	Needham Town Hall Study		
	1471 Highland Avenue Needham, MA 02492		
CLIENT	McGinley Kalsow & Associates, LLP		
	324 Broadway PO Box 45248 Somerville, MA 02145		
MacLeod Consulting, Inc. 29 Woods Road Belmont, MA 02478 (617) 484-4733 structural engineering	PROJECT NO: 2007.24		
	DATE: 1 Oct 07		
	FILE:		
	DRAWN BY: Author		
	DES'D BY: Designer		



1 End Wall Section
1" = 1'-0"

MacLeod Consulting, Inc. 29 Woods Road Belmont, MA 02478 (617) 484-4733 structural engineering	CLIENT	SHEET TITLE	
	McGinley Kalsow & Associates, LLP	End Wall Section	
	324 Broadway PO Box 45248 Somerville, MA 02145	PROJECT	Needham Town Hall Study 1471 Highland Avenue Needham, MA 02492
PROJECT NO: 2007.24			DRAWING S.3
DATE: 1 Oct 07			
FILE:			
DRAWN BY: Author			
DES'D BY: Designer			